Only connect

Only connect: comparative, national, and global history as frameworks for the history of science and technology in Asia.

Francesca Bray*

What do we, as historians of Asia, do history of science or technology *for*? Are we aiming to enhance the national or regional prestige of parts of the world that are usually treated as bit-players by the mainstream discipline? Or seeking to investigate non-Western forms of scientific or technological practice – how a society built and understood and attempted to control the world it inhabited (since we can think of science and technology as universal at least in that sense) – in order better to understand a particular period of the past in a particular place? Are we interested in using the past to serve the present? Or in using the strange to question the familiar? Are we interested in integrating non-Western facts, or dynamics, into a broader picture of how the world has evolved over time? Or in generating new historiographical heuristics?

Like me, many readers of this essay will have tried to insert their knowledge of specific local cases into broader frameworks, whether they be national or regional history, world history, global history or comparative history. In doing so we might presume that historians of science and technology working in these different fields easily engage in dialogue, and see their work as part of a common cumulative project. Yet on closer examination we see that it is often extremely difficult to communicate productively across the boundaries of the genres. Their agendas are marked off by distinctive presuppositions, research questions and interpretative frameworks. Sometimes it almost seems that historians in the various fields are looking at completely different worlds. So what exactly are we embarking on if we wish to work across and between the fields?

I have recently been prompted to reflect more rigorously than has been my custom on these questions by an invitation to contribute a chapter on 'Technological Transformations' to the 'Early Modern Era' volume of the *Cambridge World History*.[1] Both the proposed chapter title, and the dates attached to the period covered, "roughly" 1400-1800 according to the prospectus, fit neatly with the familiar narrative that depicts Europe consolidating its position through these centuries as a red-hot crucible of historical change, a story of carracks and cannon, of gear-wheels and steam-power, great inventors and patents, an invincible sequence of innovations that built the foundation for the modern colonial and industrial world-order, and stemmed from the West's unique technological creativity and economic dynamism. Clearly if I, as a historian of China, had been invited to contribute the chapter on technology to this volume, it was because the editors wanted something rather different. Yet technology as we commonly define it today is

[1] Edited by Jerry H. Bentley and Sanjay Subrahmanian.

both the midwife and the product of our modern, machine-made world. Could or should my chapter avoid taking the teleologies of modernity and the emergence in eighteenth-century Europe of what Joel Mokyr (2010) calls "Industrial Enlightenment" as its central theme, and as the point of reference for discussion of other societies?

This prompted me to ask whether world history in itself offers a satisfactory alternative to Eurocentrism. Over the last decade or so, earlier Eurocentric accounts have been reworked to develop much more inclusive narratives of how the modern world order was formed and constituted, arguing – and often successfully demonstrating – that the birth of the modern world is best understood not as an inevitable triumph of European intellectual superiority and exceptional capacities for invention, but as a 'series of transformations in which most of the people of the world participated, and to which most of them contributed, not simply as the objects or victims of the successes of others, but actively, independently and creatively' (R.I. Moore 2003: xxi). Nevertheless, despite Joseph Needham's best efforts, there are still many obstacles to integrating science into world-history narratives of complex flows and mutual influence,[2] although in the case of technology it is often feasible to demonstrate early-modern influences *on* as well as *from* Europe. Good examples include military technologies and 'global' commodities like cotton textiles or porcelain (e.g. Pacey 1991; Riello & Parthasarathi 2009; Finlay 2010). In these domains many key technological breakthroughs occurred outside Europe, and well before the dates to which the 'early modern' era is usually assigned: in the twelfth and thirteenth centuries, for example, for new regimes of warfare and defence organized around the use of gunpowder weaponry (e.g. Lorge 2008).

The world history perspective thus disturbs the conventional Eurocentric periodization that locates the beginning of a distinctive early-modern era in about 1400. But it is transformations in Europe that define the end of the period. The terminal point of the early-modern era is sometimes identified as the decade between 1830 and 1840, the point at which a new system of industrial manufacturing had clearly arrived to stay in Britain. For world or global historians, an equally important and nearly coincidental marker and theme of inquiry, variously located between 1750 and 1850, is the "Great Divergence", the point at which the nations of the West overtake their previous rivals like China, India and the Ottoman empire and accelerate far ahead in their capacity to accumulate wealth and power, and to extend their political control and intellectual dominance.

From the perspective of history of science or technology, the presence of the Great Divergence, whether as a point of reference or as the immediate object of inquiry, means that the domains of activity that are considered significant are almost invariably restricted to those identified as having played key roles in early-modern global flows and in the formation of the modern West, its values and institutions. In the case of technology, historians typically investigate the

[2] McClellan and Dorn (2006) are not unusual in drawing an epistemological line between *real* science ('scientific theorizing' in their terms), invented by the ancient Greeks, and what they call 'the useful sciences', found in all human societies.

technical, economic and political dimensions of such activities as mining and textile production, ship-building and weaponry, and methods for recording and analyzing mechanical procedures. Movement and transformation are crucial markers of significance; progress, or at the very least success in displacing other ways of making and doing, inevitably lurks as a criterion for deciding how to interpret the outcome of encounters or patterns of change: this is a history that moves us forward.

Such history seldom makes space for the cosmic, ritual or symbolic dimensions of technologies, or for their role in stabilizing and maintaining social systems. However rich in symbolic meaning technologies like building houses or weaving baskets or darning socks might have been, however indispensable they were to the pattern of the social fabric, to religious fulfilment or political cohesion, being identified with what Fernand Braudel called "the brakes" as opposed to "the accelerator" of history they find little place in these historical frameworks.

'The perspective of modern Western history and historians obfuscates a clear view of the Asian past,' fulminates Peter Lorge (2008: 7). I agree, and one of my main objections is an anthropological one: the teleologies of modern or early modern history erase or ignore key forms of past experience that may well have been an essential part of existence for the members of the societies we are studying. Furthermore, they impoverish our attention to our own contemporary forms of experience, thus paradoxically disconnecting world history, which aspires to be inclusive, from many of today's realities and concerns.

Of course in drafting my contribution to the Cambridge World History I have no intention of giving in meekly to narratives that are defined by conceptions of historical progress, even the more encompassing narratives carved out within the new frameworks of World History that allow me room to show China and India, African farmers and Andean weavers, as significant historical actors. I also want to include other perspectives. I want, for instance, to convey some sense of what the *technological culture* (Bijker 2007) of late-Ming society looked like, which branches of technical activity were considered significant, why and by whom. One argument I have made along these lines is that we can learn a great deal about late imperial China by paying attention to the role of houses, how they were designed, how their occupants used them, and what these practices contributed to an evolving social order (Bray 1998). But how can this kind of argument or exploration be fitted into the dynamisms of world history, or – given that my story about houses in China starts in the eleventh century – into its periodizations? Will readers even accept that houses can be interpreted as technology?

I realise that most of my readers probably work on later modern periods, when concepts like "science" and "technology" are already terms in common use, denoting consciously modern projects for the transformation of the world, the human condition, national status, power and wealth. Once we enter the nineteenth century, questions of periodization also *seem* less intractable: colonialism and imperialism draw the whole world into an overarching synchronicity within which local chronologies can be conveniently nested. But

perhaps thinking about an "early modern" period (with the assumption implicit in the term itself that by now societies are starting to fuse or converge into a shared if frequently resisted progress towards something called "modernity"), and thinking about the challenges to inserting "science" and "technology" into the "history of the early modern period" as I do here, will serve to highlight some of the deeper challenges of translation, of foregrounding and backgrounding, of unsatisfactory periodization, that all of us have to cope with.

The history of science or technology of anywhere or any group in the "modern" or contemporary world is inevitably comparative: what is going on in Japan, or Germany, or Sulawesi or Amazonia always has to be contextualized within a broader flow of what has become a power-laden trans-national field of knowledge production within which accuracy and truth, efficiency and originality are expected to be assessed. Even an anthropologist investigating plant knowledge among hunter-gatherers of Flores will be allocated a category within which to deploy, assess and evaluate that knowledge, namely "ethno-botany" or "vernacular science". So is the history of science actually ready for the world (Tilley 2010)?

One of the major pitfalls for comparative or even global history of science and technology is that we take one side of the comparison as the norm against which to evaluate the other. (It is far more common to see ethno-botanies tested against botany than botanies against, or as, ethnobotanies.) Comparisons, furthermore, command most attention when they offer dramatic contrasts, and it is very easy and tempting to slide into a-historical, insufficiently contextual analysis. Joseph Needham's *Science and Civilisation in China* enterprise (SCC) is an obvious example. Assessing the contribution of SCC to world history, Robert Finlay points out that Needham based the enterprise on assumptions that shaped it profoundly: SCC was a political, indeed utopian project to build a better world, based on a profound contrast: 'China and the West are antithetical in their values and social dynamics' (Finlay 2000: 267). Needham's form of comparative history translates, Finlay remarks, into the construction of a "changeless" China. Needham's decision to structure SCC as a set of parallel studies of different branches of knowledge and technique as they evolved over time, rather than as a history arranged according to dynasty, period or era, certainly helped entrench this a-historical approach.

Yet, as Finlay notes, Needham's arguments and interpretations, the image he constructs of China and of West *vs* Rest exchanges, have commanded the respect of such prominent and innovative world historians as Fernand Braudel, Janet Abu-Lughod, Immanuel Wallerstein and André Gunder Frank. Knowing little or nothing of Chinese history themselves, such historians were enchanted, Finlay remarks scathingly, by uncontextualized and sometimes tendentious generalizations. The most influential of these was the 'irresistible' contrast that Needham painted between the Chinese and Portuguese voyages of discovery.

> For Needham, the voyages of Zheng He and Vasco da Gama in the fifteenth century reveal that when China and the West reached beyond their cultural borders, they did so as thesis and antithesis, the one promising peace and increase of knowledge, the other threatening the world with terrible consequences.

(Finlay 2000: 292)

As Finlay notes, this contrast seems to 'symbolize a crucial turning point in world history' (*ibid*: 297).

While one group of world historians took the supposed contrast as emblematic of the intrinsic violence and immorality of emergent capitalism, as well as a challenge to narratives that painted the rise of the West as unique and inexorable, for others, like David Landes, the picture painted by Needham of a Ming regime that terminated the voyages just when they might have started to bring some benefits beyond the pleasing spectacle of an imported giraffe, confirmed the static and incurious nature of imperial Chinese society, mired in eternal self-satisfaction and resistant to any idea of change. In Needham's account imperial China is dynamic until around 1400 and stagnates thereafter, definitely an improvement on the Asiatic Mode of Production and its variants and antecedents. Yet the lure of the eternal essence is not confined to representations of Asia and the Other. Historians like Landes expound the trajectories of Europe or the West (the constant Us for so many comparative historians) very historically indeed, yet attribute to these dynamic, transmuting, hybrid entities a Promethean essence that determines their long-term historical evolution and characteristics. So is comparative history, or world history, an inherently a-historical enterprise?

Nowadays some (but not all) comparative historians are much more sophisticated in the selection and definition of their terms of comparison. So what makes a good, effective comparison? Is it one that commands the interest of a broad readership, and ideally changes their understanding of the possibilities of interpretation, yet without resorting to over-simplification? Should we compare coeval societies, presuming a shared periodization? Or how else might we locate a significant domain or period of activity that can profitably be compared? It is really not easy, as the following examples suggest.

A recent example of comparative history which I thoroughly enjoyed is an article by an art historian, Maarten Prak, comparing the construction methods used for large religious buildings across medieval Eurasia (Prak 2011). Prak takes Lothar Ledderose's influential idea of modular construction (Ledderose 2000) to apply it in mostly non-Chinese contexts:

> The building industry provides us with an opportunity to compare the application of cutting-edge technology under more or less identical circumstances across many different regions and cultures. It allows us, in other words, to identify the characteristics of the technological platforms for economic development available to the societies that are central to the debate on the 'Great Divergence'.
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> (Prak 2011: 382)

In arguing for the importance across Eurasia of modular construction as a way to attain often huge scales in the absence of modern engineering science, Prak offers some suggestive insights – but alas, although very well read on Europe, Prak is much less informed on the non-European cases he discusses, which drift easily into a-historical, non-localized generalities.

So do we need an expert for each term of the comparison if it is to be usefully symmetrical, as in Lloyd and Sivin's close collaboration in *The Way and the Word* (Lloyd & Sivin 2003)? One recent one-man exception to such lack of balance, and to the problems it poses for developing comparative history that offers strong rather than weak comparisons, is David Pankenier's comparison of the reception of a planetary portent in sixteenth-century China and Europe. Focusing on the observation and interpretation of one event in two different societies, Pankenier provides insights, richly contextualized on both sides, into the very different Chinese and Western responses to such "millennial" events. Resisting the usual teleologies, he provides a sensitive and nuanced comparison between distinctive (yet internally complex) systems of thinking about time and pattern, asking how interpretations of unusual events are controlled or escape control within different structures of power (Pankenier 2009).

Another fruitful avenue for comparative history might be to take up the concept of *eras*, as propounded by Thomas Misa in *Leonardo to the Internet* (Misa 2004). As Eda Kranakis notes in her review of the book, Misa's approach to eras 'draws on the tradition of political economy' yet 'takes an essential step beyond the myth of economic man' (Kranakis 2005: 807). Misa identifies a sequence of eras whose time-frames do not always coincide with conventional historical divisions. They are characterized by key preoccupations or institutions, and Misa links each to a corresponding repertory of key technologies. Rather than arguing that technological developments drove the evolution of social and political institutions, 'Misa's model shows technical eras arising out of – and in relation to – specific political and cultural systems. This difference is fundamental, and Misa's approach therefore provides new insights about the ways in which societies *choose* and *use* technologies' (*ibid*: 209, emphases added). Technological choices, like the investigation of use and users, are analytical tools initially developed by anthropologists and STS scholars, but they also offer considerable scope to historians who might wish to look more closely at the technological cultures of past societies, or to think more imaginatively about the significance (symbolic, cultural, social or political as well as material, economic or epistemological) attributed to technologies within a historical context (Bray 2007).

Thus Misa devotes an early chapter to "technologies of the court" in Renaissance Italy. His essay on Holland in the Golden Age portrays it as thoroughly capitalist but not industrial: its technical developments are better understood not as steps along a unilinear pan-European progress towards industrial mechanization, but rather as a spectrum of efforts to develop the technologies of commerce, in a network linking ship-building and financial tools with new processes for the refinement of sugar.

Misa's approach to eras reintegrates technology into mainstream historical concerns. It could also serve to build productive comparative approaches within the history of technology, and perhaps also in the history of science. Misa's era of "technologies of the court", for instance, immediately calls to mind Biagioli's *Galileo, Courtier* (Biagioli 1993). It also prompts thoughts about how the uses Italian rulers made of technology compare to the technologies of court and state

in *ancien régime* France (e.g. Mukerji 2009), or in early Qing China (Moll-Murata 2005; Gugong bowuguan 2010), or between early Ming and early Qing China.

This more ontological kind of comparison might allow us to escape from the compulsive teleologies of typical global or world history, obsessed as they still are with great divergences and convergences. In this vein I am working on a study of *significant technologies* in late imperial China, in which I hope to escape from the stranglehold of economisms by integrating the material and symbolic effects of technical practices, thus highlighting their contribution to government, both of the state and of the person (Bray forthcoming). I succeeded in convincing my editor that it was legitimate to write a book on technological cultures in China that did not to contribute to the debates on the Great Divergence except to argue that there were other histories of China to be told that were equally interesting and important. And yet comparison is an inevitable dimension of the project: how can one effectively identify the important specificities of Chinese historical experience except through comparison?

We are used always to having "Europe" or "the West" as the obvious point of comparison or reference for any other society in world or global history. But must this necessarily be so? When it comes to the *Cambridge World History*, and to the early-modern era, could I surprise and educate my readers by using China as the touchstone for Europe, rather than the other way around? Could I develop a "story" that connects outward from China to other societies in Asia, Europe, the Americas, or will this simply bring me back in the end to a tale of European destiny? Perhaps, then, in order to resist conventional teleologies, and to give proper prominence to early modern contexts in which innovation and profitability were not the chief goals of material practice, I should simply craft a patchwork of exotic vignettes that would be good to think with?

Twenty years ago Janet Abu-Lughod drew a distinction between world history, focusing on 'disparate places', and global history, focusing on 'the linkages among places and the systematic nature of those linkages' (Abu-Lughod 1991, 18–23). When I queried my Cambridge editors to establish which model they had in mind the response was roughly 'world, global, what's the difference?' Certainly there is no consensus these days on definitions or distinctions, suggesting perhaps that Abu-Lughod's category of "world history" as an engagement with disparate places in practice represents no more than an enticing way to serve up chunks of national history. The manifesto of the *Journal of World History*, for example, declares that it is 'devoted to historical analysis from a global point of view … [and] features a range of comparative and cross-cultural scholarship and encourages research on forces that work their influences across cultures and civilizations' (*JWH* 2012).

Although they were reluctant to say so, however, it became clear in the course of our discussion of my abstract that what my Cambridge History editors actually expected from me was a study that would demonstrate some variant of the argument that 'technology drives history'(Smith and Marx 1994). So is global or world or regional history necessarily about *movement* of knowledge, about

encounters between distinct sciences or technologies, about *displacements* where better knowledge prevails? Is this focus on dynamism the source from which good comparisons and critical reassessments spring?

Sujit Sivasundaram, in an introduction to a 2010 *Isis* issue on global histories of science, notes that even local histories, histories that refuse grand narratives, still concentrate on 'the conditions under which knowledge begins to move' (2010a: 96). In his longer essay Sivasundaram offers two case studies (Ceylon and Oceania under imperialism) that examine collisions between worldviews, and between material cultures of knowledge inscription. Here we see blindness and refusals as well as mutual influences, malleability and mutual re-invention. Sivasundram follows recent trends in the history of science in emphasising networks, circulation, mediators and brokers – good ways to integrate science (or technology) into global history. Yet, Sivasundaram concedes, 'mobility should not be stressed to the extent that immobility, disjuncture, and *the workings of the local* are forgotten' (Sivasundaram 2010b: 158, emphasis added). But how to suture immobility (often achieved at considerable effort) into models built around mobility?

Where, furthermore, do we locate the local? This remains a dilemma, as does the underlying issue of mobility as catalyst and historiographical trigger. In their introduction to *Viet Nam: Borderless Histories*, Nhung Tuyet Tran and Anthony Reid (2006) remind us of the many historians of Asian societies (Prasenjit Duara for China, Partha Chatterjee and other subaltern historians for India, Thai historians like Thongchai Winichakul) who want "the nation" out of history. Many advocate writing history 'from the interstices of cultures, from the limits, the edges, the margins that are no longer marginal' (*ibid*: 4). This approach has a proven efficacy in complicating the history of science and technology –examples might include the history of warfare as the advantages shifted back and forth within Asia and between Asia and Europe (Perdue 2005; Sun 2006; Casale 2010; Andrade 2011), or the evergreen theme of "Jesuit science" in China – which has the further advantage of fascinating and engaging historians of the West because Westerners are involved.

But how might borderland studies fit into broader historical pictures? How do they fit with national or regional histories in the domain of science and technology, where state institutions and shared modes of literacy play such a key role in determining fields of activity as well as our sources? Is there room in world or global history for the complicated multi-stranded stories, stories usually without any clear ending or winner, that come out of borderland studies? Can world or global history accommodate non-linear comparisons, say between French and Manchu eras of technologies of the court, or offer any kind of intellectual added-value to self-contained case-studies of the place of science in Islamic thought, or of the importance of domestic architecture to the imperial Chinese social order? In short, is world history of science and/or technology a valid enterprise, or would we be better employed adding colourful new patches to the great quilt of what Abu-Lughod called the study of disparate places?